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Ministry of the ENVIRONMENT



Water Quality Survey Musselman Lake

Town of Whitchurch-Stouffville
Regional Municipality of York

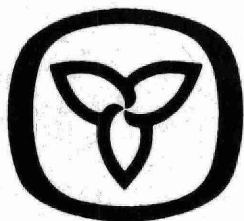
1972

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Environment Ontario



REPORT
ON A
WATER QUALITY SURVEY
OF
MUSSELMAN LAKE
TOWN OF WHITCHURCH-STOUFFVILLE
REGIONAL MUNICIPALITY OF YORK

1972

DISTRICT ENGINEERS SECTION
SANITARY ENGINEERING BRANCH

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I INTRODUCTION

A water quality survey of Musselman Lake was conducted in May and August, 1971.

This survey was made at the request of the Council of the Corporation of the Town of Whitchurch-Stouffville. Personnel of the District Engineers Section carried out the survey to determine the existing physical, chemical and bacteriological condition as well as the nutrient levels of the lake.

II GENERAL

Musselman Lake is located approximately 1.5 miles north of Stouffville. The lake has an estimated surface area of 118 acres, with a maximum depth of approximately 27 feet. This landlocked lake is situated in the Holland River Watershed and is apparently fed by springs and surface runoff.

There are roughly 375 and 182 residences used during the summer and winter months respectively. Two privately-owned beaches are also located on the lake at the northern and southern sides.

III WATER USES

(i) Recreational

This lake is used for resort purposes. A number of row boats and canoes are available from Glendale Beach and Cedar Beach Park. Other activities include swimming, water sports and fishing.

(ii) Water Supply

In the event that the lake water is used by individuals as a source of

drinking water, it should, like any other surface water receive at least chlorination treatment.

Cedar Beach Park has a water works sytem which supplies drinking water from 2 wells to about 120 of the 196 trailer park units plus the rest of the park facilities. Water from the lake is used for watering lawns and for washroom uses. Future plans include an additional reservoir for proposed trailer park units. It should be noted that this park has a permit issued by our Water and Well Management Section restricting them to a water usage of 20,000 gallons per day and 3,000 gallons per day for the new lake intake and the new well respectively.

Glendale Beach has a well which supplies drinking water to the park facilities and again the lake water is used for washroom uses.

It should be noted that lake water was used in the wash basin at Cedar Beach Park and this contravenes Section 153 and 27 of Regulation 647 under the Ontario Water Resources Act. These sections state that non-potable water can be used to flush urinals or waterclosets but not used in fixtures which could be accessible as a supply of water for human consumption (ie. wash basins in washrooms).

The drinking water samples collected in 1971 from both the private park by the Health Unit have been free of coliform bacteria.

IV SANITARY WASTE DISPOSAL

The most common method of sewage disposal is via septic tank and tile bed systems. There have been no complaints of any faulty systems in the

past year according to the York Regional Health Unit.

Cedar Beach Park is situated on approximately 70 acres and has 14 septic tank systems which serve the park area plus the trailer park units. This park can accommodate between 1,000 to 3,000 persons. The soil type at this part of the lake is Brighton Sandy Loam (BRSL) according to the soil survey of York County. This loam is formed on coarse sandy outwash material and has smooth gently sloping topography.

Glendale Beach which is located on the southern side of the lake has a septic tank system which serves two sets of washrooms. This park is located on approximately five acres of land and reportedly can accommodate about 1,000 people. The soil type for this portion of the lake is Pontypool sandy loam (Ps). This loam is light textured, well drained on irregular steeply sloping topography.

V RESULTS OF LABORATORY ANALYSES

The laboratory results of the bacteriological examinations and the chemical analysis of samples collected from the lake are included in the tables appended to this report.

The bacteriological results of the lake samples were low and quite acceptable for a surface water. The median concentration of total and fecal coliforms per 100 ml for the days sampled were 10 and 1 respectively. The median concentrations mentioned above were obtained from sample results taken at Stations A, B and C and the perimeter of the lake. The median dissolved oxygen (D.O.) levels in the lake for May 19 and August 4, 1971 were 11 ppm and 9 ppm respectively. These levels were obtained from samples of water

taken at the top and bottom of the lake at Stations A, B and C.

The phenol concentrations which are recorded in parts per billion (ppb) ranged from 0 ppb to 20 ppb with 90 per cent of the samples being less than or equal to 6 ppb. The sample which contained the 20 ppb was taken in a small bay on the north-western corner of the lake. On this particular day the wind was blowing from a south-east to north-west direction.

The total algal levels were moderately high with a normal seasonal shift from diatoms in May to the blue-green group in August. This coincides with chlorophyll-secchi disc data which shows very low chlorophyll "a" and "b" levels in May and an increase in chlorophyll "a" levels in August while the "b" levels remained low. This increase reflects the dominance of blue-green algae at that time. The chlorophyll-secchi disc levels would suggest that the productivity in Musselman Lake is fairly low.

VI OBSERVATIONS

The procedure which was followed during the survey was to set up three sampling stations plus sample the perimeter of the lake. At these locations aquatic plant were found growing on the lake bottom. It should be noted that the plant growth was not excessive.

On August 4, 1971 when district staff were sampling the southern shore a black jelly-like matrix was noted being washed up on the shore. At first observation this matrix appeared to be raw sewage but later when it was examined by our Biology Section it was found to be a form of algae. This algae which is usually a blue-green type produces the jelly

for protection and to entrap food. The jelly is built up in layers and the matrix is mostly made up of this jelly.

At each sampling station the temperature was taken at different depths along with the dissolved oxygen (D.O.). The depth of photic zone and water were also taken at the above stations.

The information obtained at the three sampling stations is in Table 1 which is appended to this report.

Plastic pipes could be seen running from the lake to both the private beach parks and to some individual cottages. These pipes were probably used for washroom facilities or for lawn watering.

Some corrugated metal and concrete outfalls were also observed at the northern and southern sides of the lake and these were used for draining the sideroads.

VII SUMMARY AND RECOMMENDATIONS

Sampling runs to determine the water quality in Musselman Lake were made in May and August, 1971.

This lake is used for resort purposes such as boating, swimming, water sports and fishing. Two private parks situated on the lake promote most of the above activities.

Drinking water is obtained from wells on an individual basis with the lake

water being used for watering lawns and washrooms. Lake water can be used in urinals and waterclosets but not in wash basins or any other fixture which could be accessible as a supply of water for human consumption.

The most common method of sewage disposal is via septic tank and tile bed systems.

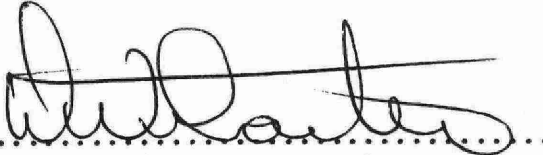
The bacteriological and chemical results were quite acceptable for a surface water. The median concentrations of total and fecal coliform per 100 ml were 10 and 1 respectively. The median D.O. levels in the lake for May 19 and August 4 were 11 ppm and 9 ppm respectively. It should be noted that 90 per cent of the phenol samples were less than or equal to 6 ppb.

The biological results indicated that the lake is in good condition. This is confirmed by the chlorophyll-secchi disc levels which suggest that the productivity in Musselman Lake is fairly low.

Recommendations

1. All precautions, particularly with regard to growth and development adjacent to the lake, should be taken to maintain the excellent water quality now existing.

2. The municipality should ensure that every park around or near the lake adhere to Regulation 647 under the OWRA, Sections 27 and 153 which states that non-potable water cannot be used in fixtures which could be accessible as a supply of water for human consumption.

Prepared by:.....

D. W. Carter, Technologist
District Engineers Section
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/cs

GLOSSARY OF TERMS

Bacteriological Examinations - The Membrane Filter Technique is used to obtain a direct count of coliform organisms. These organisms are the normal inhabitants of the intestines of man and other warm-blooded animals. They are always present in large numbers in untreated sewage and are, in general, relatively few in number in other stream pollutants.

Biochemical Oxygen Demand (BOD) - The biochemical oxygen demand test indicates the amount of oxygen required for stabilization of the decomposable organic matter found in sewage, sewage effluent, polluted waters, or industrial wastes, by aerobic biochemical action.

Solids - The analyses for solids include tests for total, suspended and dissolved solids. The total solids is a measure of the solids in solution and in suspension. Suspended solids indicate the measure of undissolved solids of organic or inorganic nature whereas the dissolved solids are a measure of those solids in solution.

Nitrogen

Ammonia Nitrogen or sometimes called free ammonia is the soluble product in the decomposition of nitrogenous organic matter. It is also formed when nitrates and nitrites are reduced to ammonia either biologically or chemically. Some small amounts of ammonia, too, may be swept out of the atmosphere by rain water.

The following values may be of general significance in appraising free ammonia content: low 0.015 to 0.03 ppm; moderate 0.03 to 0.10 ppm; high 0.10 or greater.

Total Kjeldahl is a measure of the total nitrogenous matter present except that measured as nitrite and nitrate nitrogens. The Total Kjeldahl less the Ammonia Nitrogen measures the organic nitrogen present. Ammonia and

organic nitrogen determinations are important in determining the availability of nitrogen for biological utilization. The normal range for Total Kjeldahl would be 0.1 to 0.5 ppm.

Nitrite Nitrogen

Nitrite is usually an intermediate oxidation of ammonia. The significance of nitrites, therefore, varies with their amount, sources, and relation to other constituents of the sample, notably the relative magnitude of ammonia and nitrite present. Since nitrite is rapidly and easily converted to nitrate, its presence in concentrations greater than a few thousandths of a part per million is generally indicative of active biological processes in the water.

Nitrate Nitrogen

Nitrate is the end product of aerobic decomposition of nitrogenous matter, and its presence carries this significance. Nitrate concentration is of particular interest in relation to the other forms of nitrogen that may be present in the sample. Nitrates occur in the crust of the earth in many places and are a source of its fertility.

Phosphorus

Total Phosphorus - Total Phosphorus is a measure of both the organic and inorganic forms of phosphorus present.

Soluble Phosphorus - Soluble Phosphorus is a measure of the orthophosphate only and when subtracted from the total phosphorus gives an indication of the concentration of organic phosphorus present. That is, the soluble phosphorus is a measure of the inorganic phosphorus present, except the phosphorus

in the form of polyphosphate, which however, in surface waters is usually insignificant. Inorganic phosphorus in concentration in excess of 0.01 ppm may cause nuisance conditions.

Phenolic Compounds - Phenols are hydroxy derivatives of benzene and its condensed nuclei. They are usually present in surface water as a result of contact with petroleum products.

TOWN OF WHITCHURCH-STOUFFVILLE

MUSSELMAN LAKE

May 19 & August 4

STATION A

<u>DATE</u>	<u>DEPTH</u>	<u>DISC</u>	<u>PHOTIC ZONE</u>	<u>D.O.</u>	<u>TEMPERATURE</u>
May	4m	3.5m	4m	4m - 11 mg/l	15°C
				1m - 11 mg/l	15°C
Aug.	4m	3.5m	4m	4m - 9 mg/l	20°C
				1m - 9 mg/l	22°C

STATION B

May	4m	3.5m	4m	4m - 13 mg/l	15°C
				1m - 12 mg/l	15°C
Aug.	3.3m	3m	3.5m	3m - 9 mg/l	20°C
				1m - 9 mg/l	23°C

STATION C

May	6m	3.5m	6m	6m - 11 mg/l	15°C
				1m - 13 mg/l	15°C
Aug.	6m	3.5m	6m	6m - 6 mg/l	20°C
				1m - 8 mg/l	22°C

TOWN OF WHITCHURCH-STOUFFVILLE

MUSSELMAN LAKE

May 18 and August 4

STATION A

DATE	DEPTH	CHLOROPHYLL ($\mu\text{g}/\text{l}$)		VOLUME FILTERED
		"a"	"b"	
May	4m	0.9	0.5	750 ml
Aug.		3.7	0.2	500 ml

STATION B

May	4m	0.5	0.5	700 ml
Aug.		3.4	0.4	500 ml

STATION C

May	6m	0.5	0.4	900 ml
Aug.		3.2	0.4	500 ml

TOWN OF WHITCHURCH-STOUFFVILLE

MUSSELMAN LAKE

SAMPLE PT. NO.	LOCATION	DATE	BOD (mg/l)	SOLIDS (mg/l)			PHOSPHORUS AS P		Free Ammonia	NITROGEN AS N (mg/l)		
				Tot.	Susp.	Diss.	Tot.	Sol.		Total Kjeldahl	Nitrite	Nitrate
ML-1	East of Cedar Beach	18/5/71 5/8/71										
ML-2	N.E. corner of lake	18/5/71 5/8/71	1.2 1.0	160 180	5 5	155 175	.018 .022	.001 .002	.01 .01	.51 .50	.006 .001	.13 .01
ML-3	Bend in East Shore	18/5/71 5/8/71										
ML-4	East side by purple house	18/5/71 5/8/71	1.2 1.4	160 190	5 5	155 185	.014 .018	.012 .001	.02 .01	.51 .43	.001 .001	.15 .01
ML-5	Glendale Beach	18/5/71 5/8/71										
ML-5A	South Shore	18/5/71 5/8/71										
ML-6	Bend in South Shore	18/5/71 5/8/71	1.6 1.0	140 170	5 5	135 165	.014 .014	.002 .001	.01 .01	.50 .41	.006 .001	.13 .01
ML-7	Off boathouse with blue door	18/5/71 5/8/71										
ML-8	Bay in N.W. corner of lake	18/5/71 5/8/71	1.6 1.0	170 170	5 5	165 165	.016 .018	.010 .001	.02 .01	.60 .50	.007 .001	.15 .01

SAMPLE PT. NO.	LOCATION	DATE	BOD (mg/l)	SOLIDS (mg/l)			PHOSPHORUS AS P (mg/l)		Free Ammonia	NITROGEN AS N (mg/l)		
				Tot.	Susp.	Diss.	Tot.	Sol.		Total Kjeldahl	Nitrite	Nitrate
ML-9	N.W. Shore	18/5/71 5/8/71										
ML-10	North Shore	18/5/71	1.8	150	5	145	.014	.002	.01	.54	.006	.15
		5/8/71	1.0	190	5	185	.012	.002	.01	.41	.001	.01
ML-11	Bay on North Shore	18/5/71										
		5/8/71										
ML-12	Cedar Beach	18/5/71	1.5	150	5	145	.016	.006	.01	.51	.006	.15
		5/8/71	1.0	180	5	175	.016	.016	.01	.43	.001	.01

TOWN OF WHITCHURCH-STOUFFVILLE

MUSSELMAN LAKE

SAMPLE PT. NO.	LOCATION	DATE	IRON	SILICA	MANGANESE	PHENOLS	COLIFORMS /100 ml	
			as Fe (mg/l)	as SiO (mg/l) 2	as Mn (mg/l)	(ppb)	Total	Fecal
ML-1	East of Cedar Beach	18/5/71	-	-	-		40	1
		5/8/71	-	-	-		0	0
ML-2	N.E. Corner of Lake	18/5/71	-	-	-	4		
		5/8/71	-	-	-	6		
ML-3	Bend in East Shore	18/5/71	-	-	-		28	1
		5/8/71	-	-	-		8	0
ML-4	East side of purple house	18/5/71	-	-	-	4		
		5/8/71	-	-	-	4		
ML-5	Glendale	18/5/71	-	-	-		32	1
ML-6	Bend in South Shore	18/5/71	-	-	-	4		
		5/8/71	-	-	-	2		
ML-7	Off boathouse with blue door	18/5/71	-	-	-		4	1
		5/8/71	-	-	-		20	2

TOWN OF WHITCHURCH-STOUFFVILLE

MUSSELMAN LAKE

SAMPLE PT. NO.	LOCATION	DATE	IRON		SILICA		MANGANESE as Mn (mg/l)	PHENOLS (ppb)	COLIFORMS/100 ml	
			As	Fe	as	SiO ₂			Total	Fecal
			(mg/l)	(mg/l)	(mg/l)	(mg/l)				
ML-8	Bay in N.W. corner of Lake	18/5/71	-	-	-	-	-	20		
		5/8/71	-	-	-	-	-	2		
ML-9	N.W. Shore	18/5/71	-	-	-	-	-		20	1
		5/8/71	-	-	-	-	-		10	0
ML-10	North Shore	18/5/71	-	-	-	-	-	4		
		5/8/71	-	-	-	-	-	10		
ML-11	Bay on North Shore	18/5/71	-	-	-	-	-		20	1
		5/8/71	-	-	-	-	-		4	0
ML-12	Cedar Beach	18/5/71	-	-	-	-	-	2		
		5/8/71	-	-	-	-	-	2		

TOWN OF WHITCHURCH-STOUFFVILLE

MUSSELMAN LAKE - STATION "A"

SAMPLE PT. NO.	LOCATION	DATE	BOD	SOLIDS			PHOSPHORUS AS P		Free Ammonia	NITROGEN AS N		
				Tot.	Susp.	Diss.	Tot.	Sol.		Total Kjeldahl	Nitrite	Nitrate
L-1	1 meter depth	18/5/71	1.1	160	5	155	.016	.004	.02	.52	.008	.15
		4/8/71	1.2	100	5	95	.017	.006	.01	.48	.001	.02
L-2	4 meter depth	18/5/71	1.4	160	5	155	.021	.003	.02	.59	.006	.15
		4/8/71	1.6	130	5	125	.019	.002	.01	.49	.002	.01

TOWN OF WHITCHURCH-STOUFFVILLE

MUSSELMAN LAKE - STATION "A"

SAMPLE PT. NO.	LOCATION	DATE	IRON	SILICA	MANGANESE	PHENOLS	COLIFORMS	
			as Fe	As SiO ₂	as Mn		Total	Fecal
L-1	1 meter depth	18/5/71	.07			2	8	1
		4/8/71	.05	.63	.04	6	10	1
L-2	4 meter depth	18/5/71	.08			3	4	1
		4/8/71	.10	.67	.05	0	10	1

TOWN OF WHITCHURCH-STOUFFVILLE

MUSSELMAN LAKE - STATION "B"

SAMPLE PT. NO.	LOCATION	DATE	BOD	SOLIDS			PHOSPHORUS AS P		Free Ammonia	NITROGEN AS N		
				Tot.	Susp.	Diss.	Tot.	Sol.		Total Kjeldahl	Nitrite	Nitrate
K-1	1 meter	18/5/71	0.9	156	5	151	.014	.001	.01	.52	.006	.05
		4/8/71	1.4	100	5	95	.020	.003	.01	.49	.001	.01
K-2	4 meter	18/5/71	1.1	154	5	149	.019	.003	.02	.54	.007	.15
		4/8/71	1.4	120	5	115	.020	.001	.01	.49	.001	.01

TOWN OF WHITCHURCH-STOUFFVILLE

MUSSELMAN LAKE - STATION "B"

SAMPLE PT. NO.	LOCATION	DATE	IRON as Fe	SILICA as SiO ₂	MANGANESE as Mn	PHENOLS	COLIFORMS Total	Fecal
K-1	1 meter	18/5/71	.05				16	11
		4/8/71	.05	.90	.04	0	10	1
K-2	4 meter	18/5/71	.07				8	1
		4/8/71	.05	.76	.05	6	-	-

TOWN OF WHITCHURCH-STOUFFVILLE

MUSSELMAN LAKE - STATION "C"

SAMPLE PT. NO.	LOCATION	DATE	BOD	SOLIDS			PHOSPHORUS AS P		Free Ammonia	NITROGEN AS N		
				Tot.	Susp.	Diss.	Tot.	Sol.		Total Kjeldahl	Nitrite	Nitrate
M-1	1 meter	18/5/71	1.2	140	5	135	.015	.002	.02	.52	.008	.17
		5/8/71	1.2	130	5	125	.021	.018	.01	.47	.001	.18
M-2	6 meter	18/5/71	0.8	160	5	155	.021	.004	.01	.57	.007	.13
		5/8/71	1.0	130	5	125	.025	.002	.01	.52	.002	.03

TOWN OF WHITCHURCH-STOUFFVILLE

MUSSELMAN LAKE - STATION "C"

SAMPLE PT. NO.	LOCATION	DATE	IRON as Fe	SILICA as SiO ₂	MANGANESE	PHENOLS	COLIFORMS TOTAL	FECAL
M-1	1 meter	18/5/71	.06	.38			4	1
		5/8/71	.05	.58	.06	0	10	1
M-2	6 meter	18/5/71	.07	.35			8	1
		5/8/71	.10	.65	.05	0	320	1



ENVIRONMENT ONTARIO	
MUSSELMAN LAKE	
TOWN OF WHITCHURCH - STOUFFVILLE	
WATER QUALITY SURVEY	
1972	
SCALE: 1" = 400' Approx.	
DRAWN BY: L. L. BROOME	DATE: JUNE, 1971
CHECKED BY: D. C.	DRAWING NO: 71-56-DE



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